

RF Test Report

Project Number: 5002314**Offer Number:** SUW-202210003592**Report Number:** 5002314EMC01**Revision Level:** 1**Client:** iKeyless, LLC**Equipment Under Test:** Keyless Entry Remote Control**Model / HVIN:** HNHKL-G050**FCC ID:** X32-HNHKG050**IC:** 8797A-HNHKG050**Applicable Standards:** FCC Part 15 Subpart C, § 15.231 Periodic Operation in the band 40.66-40.77MHz and above 70MHz**ANSI C63.10:** 2013**RSS-210, Issue 10 (Annex A)****RSS-GEN Issue 5****Report issued on:** 02 February 2023**Report Revision on:** 02 March 2023**Test Result:** Compliant

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER: 3212.01

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1 Summary of Test Results

Test Description	Test Specification	Test Result
Antenna requirement	47 CFR Part 15, Subpart C 15.203	Compliant
Field strength of fundamental	15.231(b); RSS-210 A.1.2(a) ANSI C63.10:2013, Section 6.5	Compliant
Field strength of spurious radiation	15.231(b); RSS-210 A.1.2(b) ANSI C63.10:2013, Section 6.5	Compliant
Bandwidth	15.231(c); RSS-210 A.1.3 ANSI C63.10:2013, Section 6.9	Compliant
Deactivation time (manual)	15.231(a)(1); RSS-210 A.1.1(a) ANSI C63.10:2013, Section 7.4	Compliant
Polling transmissions	15.231(a)(3); RSS-210 A.1.1(c)	N/A ¹
Transmission time for setup	15.231(a)(5) ANSI C63.10:2013, Section 7.4	N/A ²
Frequency stability	15.231(d) ANSI C63.10:2013, Section 6.8	N/A ³

Note 1: Not applicable since this device does not use polling or supervision transmissions.

Note 2: Not applicable since the transmission duration limits in paragraph (a)(1) are met.

Note 3: Not applicable since this device does not operate within the frequency band 40.66-40.70MHz.

1.1 Modifications Required for Compliance

None

2 General Information

2.1 Client Information

Name: iKeyless LLC
Address: 12101 Sycamore Station Place, Suite 101
City, State, Zip, Country: Louisville, KY 40299

2.2 Test Laboratory

Name: SGS North America, Inc.
Address: 620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country: Suwanee, GA 30024, USA

Accrediting Body: A2LA
Type of lab: Testing Laboratory
Certificate Number: 3212.01
ISED CAB Identifier: US0186
FCC Designation Number: US1126

2.3 General Information of EUT

Type of Product: Keyless Entry Remote Control
Product Marketing Name (PMN): HNHKL-G050
Model Number (HVIN): HNHKL-G050
Firmware Version ID (FVIN): HNHKL-F010
Sample ID: SUWEM2301000004
FCC ID: X32-HNHKG050
IC: 8797A-HNHKG050

Frequency Range: 433.92 MHz
Modulation: FSK
Antenna: PCB trace loop

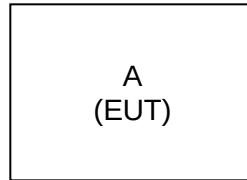
Rated Voltage: 3Vdc CR1620 coin cell battery
Test Voltage: 3Vdc CR1620 coin cell battery

Sample Received Date: 01 January 2023
Dates of testing: 24 January to 01 February 2023; March 1, 2023

2.4 Operating Modes and Conditions

The EUT was powered by one standard CR1620 coin cell battery during testing. Two types of samples were provided to SGS: normal and test mode. The test mode sample was configured by the client such that a button press would start a continuous transmit signal using the same modulation and power as a normal transmit signal but with a higher duty cycle than normal to make most testing easier. Pressing a different button would stop the continuous transmit signal. The normal sample was configured to operate as it would in the field with temporary transmissions triggered by pressing the various buttons. This sample was used to test the deactivation time as well as the normal operational duty cycle.

2.5 EUT Connection Block Diagram – Radiated Measurements



Inside Chamber

Outside Chamber

2.6 System Configurations

Device reference	Manufacturer	Description	Model Number	Serial Number
A	iKeyless LLC	Keyless Entry Remote Control	HNHKL-G050	(not labeled) Sample ID: SUWEM2301000004

3 Antenna Requirement

3.1 Result

Test Description	Test Specification	Test Result
Antenna requirement	FCC 15.203	Compliant

3.2 Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

3.3 Conclusion

The antenna in the device is a loop PCB trace antenna. It is permanently attached and thus meets the antenna requirement.

4 Field Strength of Fundamental

4.1 Test Result

Test Description	Test Specification		Test Result
Field strength of fundamental	15.231(b)	RSS-210 A.1.2	Compliant
	ANSI C63.10:2013, Section 6.5		

Note: Output power was reduced by an average of ~7 dB.

4.2 Test Method

The test data was measured using a Peak detector. Average measurements were made by correcting the peak value with the duty cycle correction factor. The receiver's resolution bandwidth was set to 120 kHz for measurements taken in the 30MHz to 1GHz frequency range and 1MHz for measurements for 1GHz and higher. Measurements were made with the antenna positioned at a 3m distance from the EUT in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency. The radiated measurements were recorded and compared to the limits indicated in the table below.

The EUT was oriented in each of its three orthogonal axes and data for each was reported.

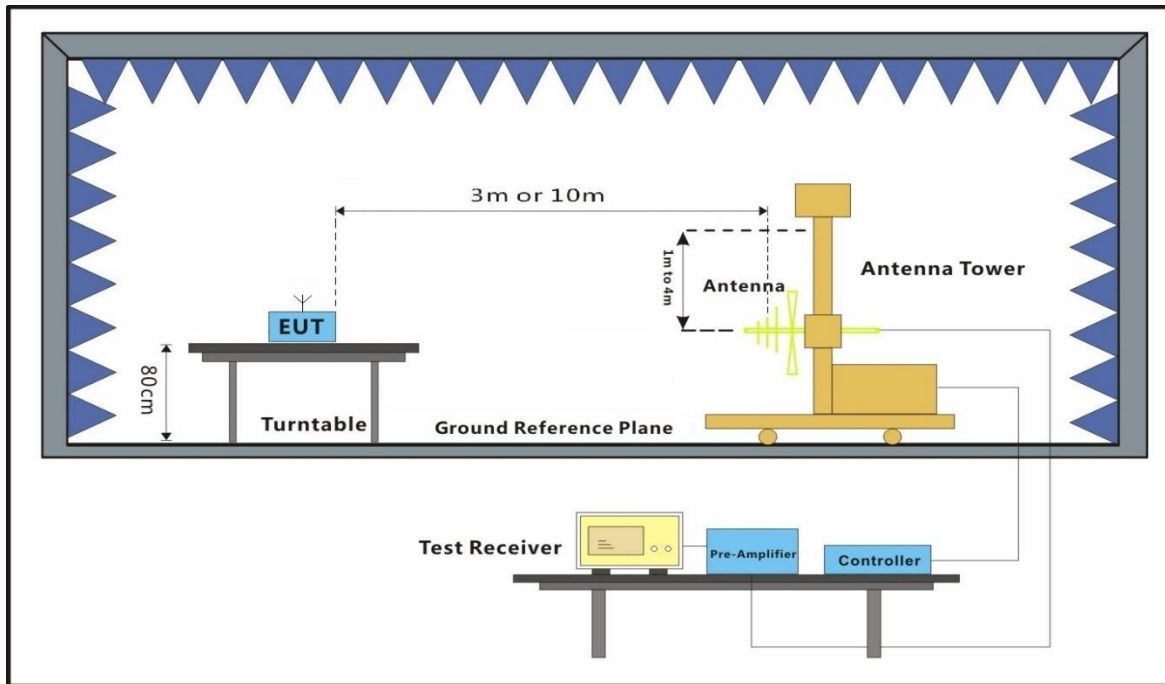
Limits for average value of emissions measured at 3m distance

Fundamental frequency (MHz)	FCC	RSS-210
	Field strength of fundamental (microvolts/meter)	Field strength of fundamental (microvolts/meter)
40.66-40.70	2,250	Not allowed
70-130	1,250	
130-174	1,250 to 3,750 ¹	
174-260	3,750	
260-470	3,750 to 12,500 ¹	
Above 470	12,500	

1) Linear interpolations

From the table above, the fundamental limit for a 433.93 MHz fundamental frequency is determined by linear interpolation to be 80.83 dBuV/m.

4.3 Test Setup Diagram



4.4 Test Site

10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Test Date:	27-Jan-2023	01-Feb-2023	01-Mar-2023
Temperature:	21.3°C	21.8 °C	22.5 °C
Relative Humidity:	23.0 %	39.6 %	39.0 %
Atmospheric Pressure:	98.8 kPa	98.6 kPa	97.9 kPa

4.5 Test Equipment

Test End Date: 27-Jan-2023

Tester: DA

Equipment	Model	Manufacturer	Asset	Cal Date	Cal Due Date
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	7-Dec-2022	7-Dec-2023
RF CABLE (TS8997)	141	HUBER & SUHNER	B095585	5-Jul-2022	5-Jul-2023
NEAR FIELD PROBES	N/A	COM-POWER CORPORATION	16016	CNR	CNR

Test End Date: 1-Feb-2023

Tester: DA

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
EMI TEST RECEIVER	ESW44	ROHDE & SCHWARZ	22027	13-Sep-2022	13-Sep-2023
RF CABLE RIGHT ANGLE NM TO LOW NOISE AMPLIFIER	90-076-020	TELEDYNE STORM MICROWAVE	20131	16-Mar-2022	16-Mar-2023
RF CABLE NM TO NM, 0.01-18GHZ	90-195-079	TELEDYNE STORM MICROWAVE	20124	14-Feb-2022	14-Feb-2023
RF CABLE	SF106	HUBER & SUHNER	B079713	25-Aug-2022	25-Aug-2023
N to N RF Cable	NC12-N1N1-276	MEGAPHASE	22000	9-Jan-2023	9-Jan-2024
ANTENNA, BILOG	JB6	SUNOL	B079690	19-Apr-2022	19-Apr-2024

Test End Date: 1-Mar-2023

Tester: DA

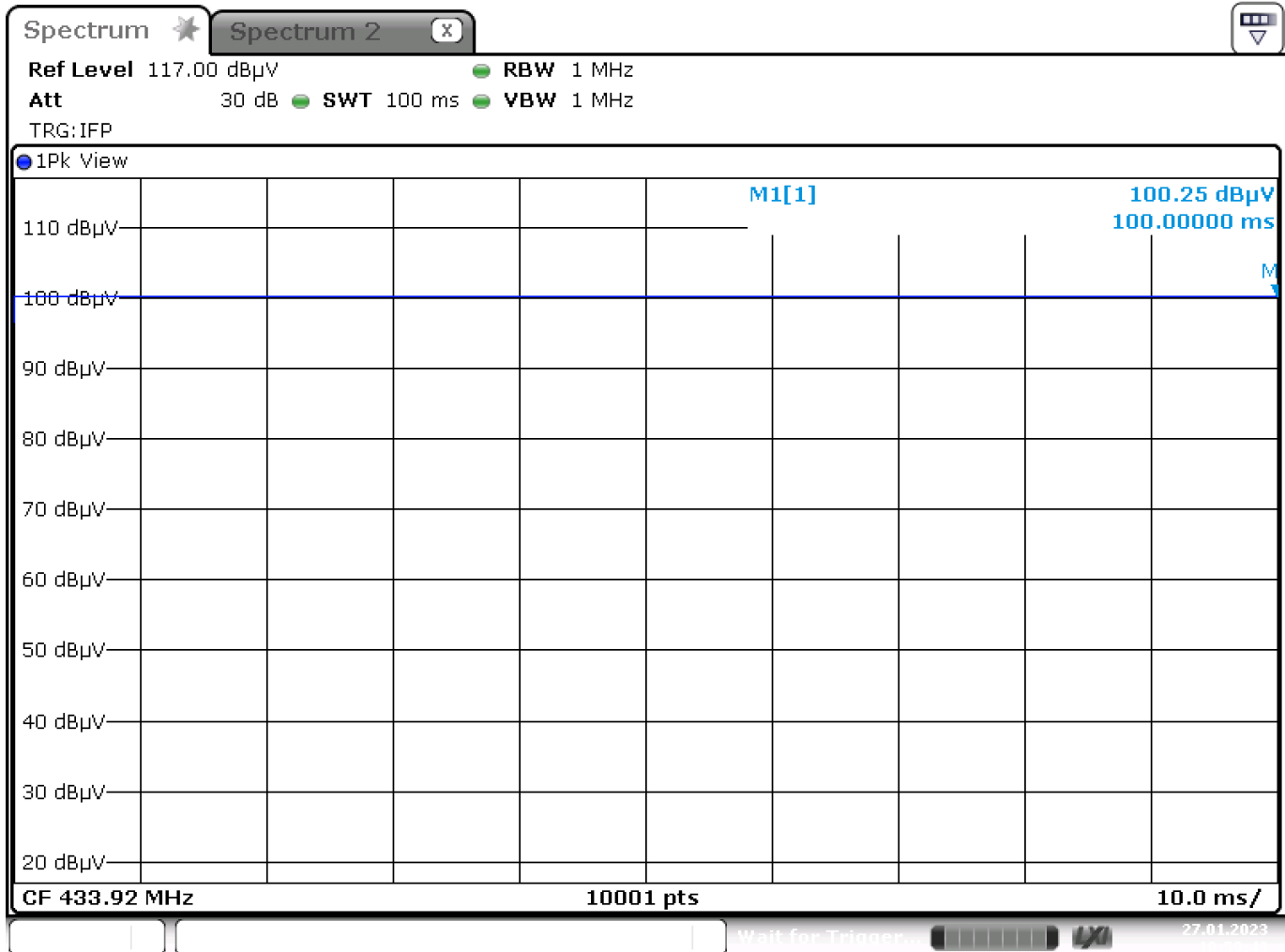
Equipment	Model	Manufacturer	Asset	Cal Date	Cal Due Date
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	7-Dec-2022	7-Dec-2023
RF CABLE (TS8997)	141	HUBER & SUHNER	B095588	5-Jul-2022	5-Jul-2023

Software: "RSE 30-1000 MHz T7 220318" TILE7 profile dated 18 March 2022

4.6 Duty Cycle Correction Factor (DCCF)

Normal Operation of Device:

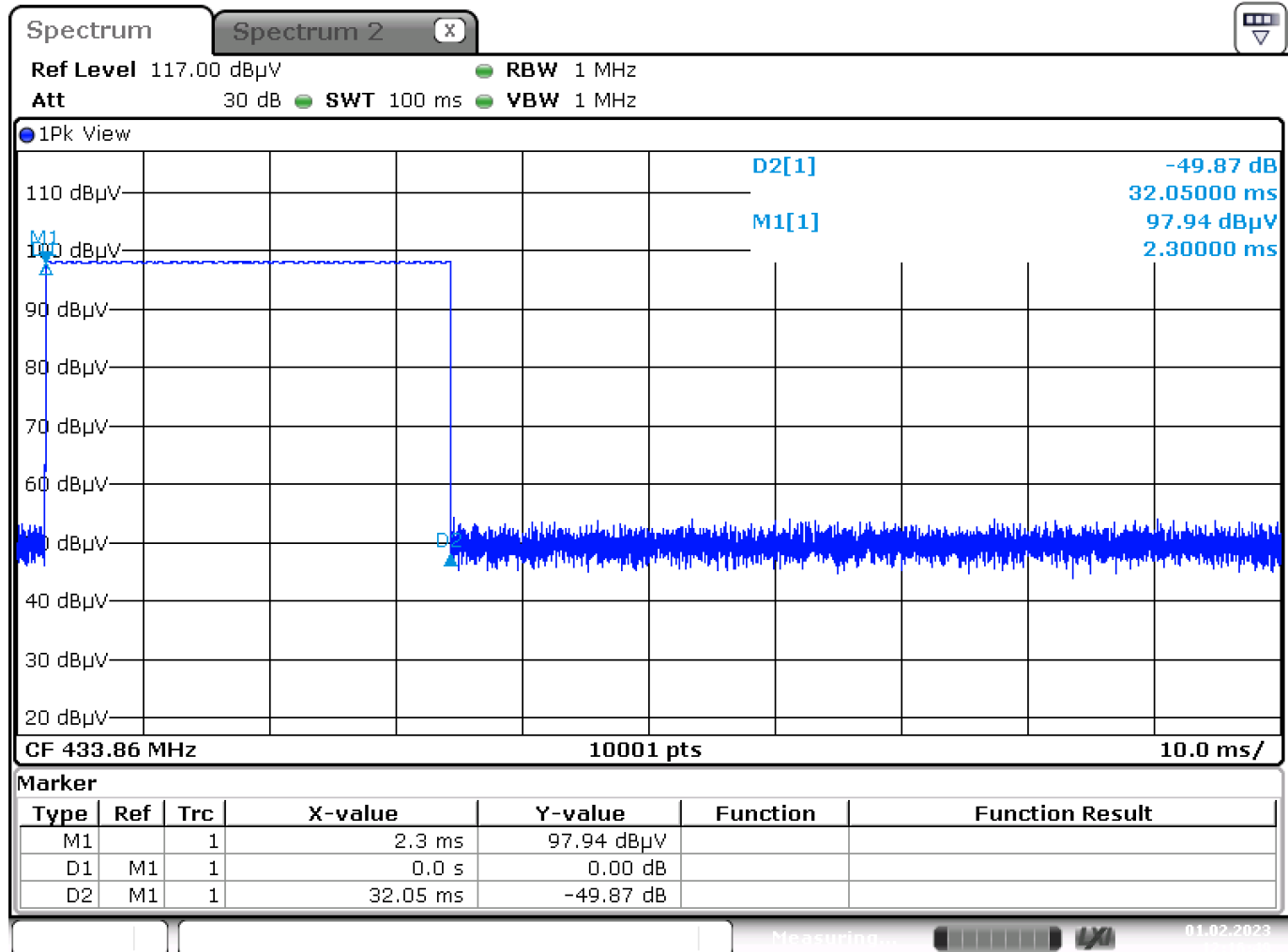
Duty Cycle				
Configuration	TX ON (ms)	Period, T (ms)	Duty Cycle (%)	DCCF (dB)
Normal	100	100	100	0



Date: 27.JAN.2023 10:59:43

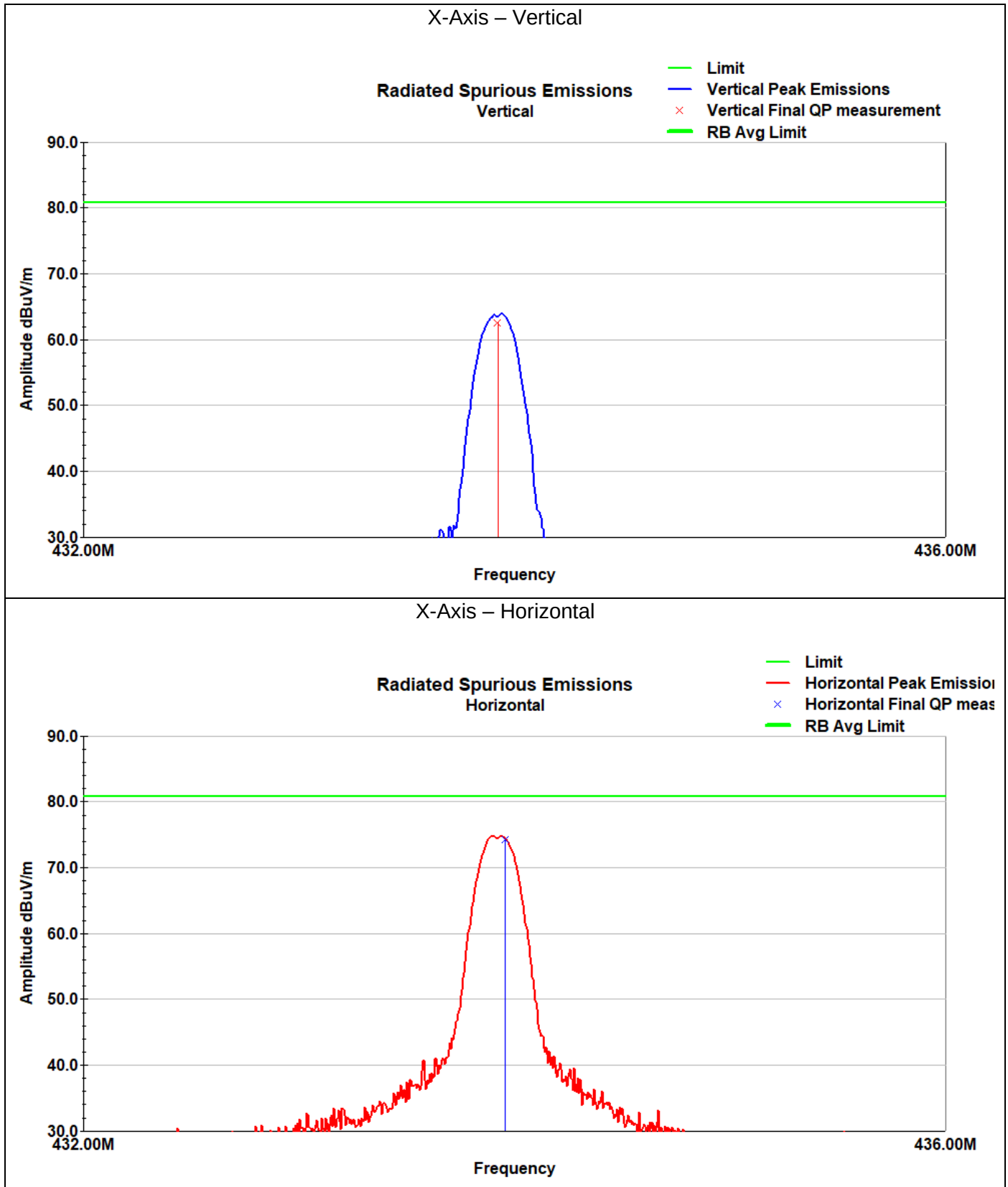
Duty Cycle of Device when set to Continuous Operation:

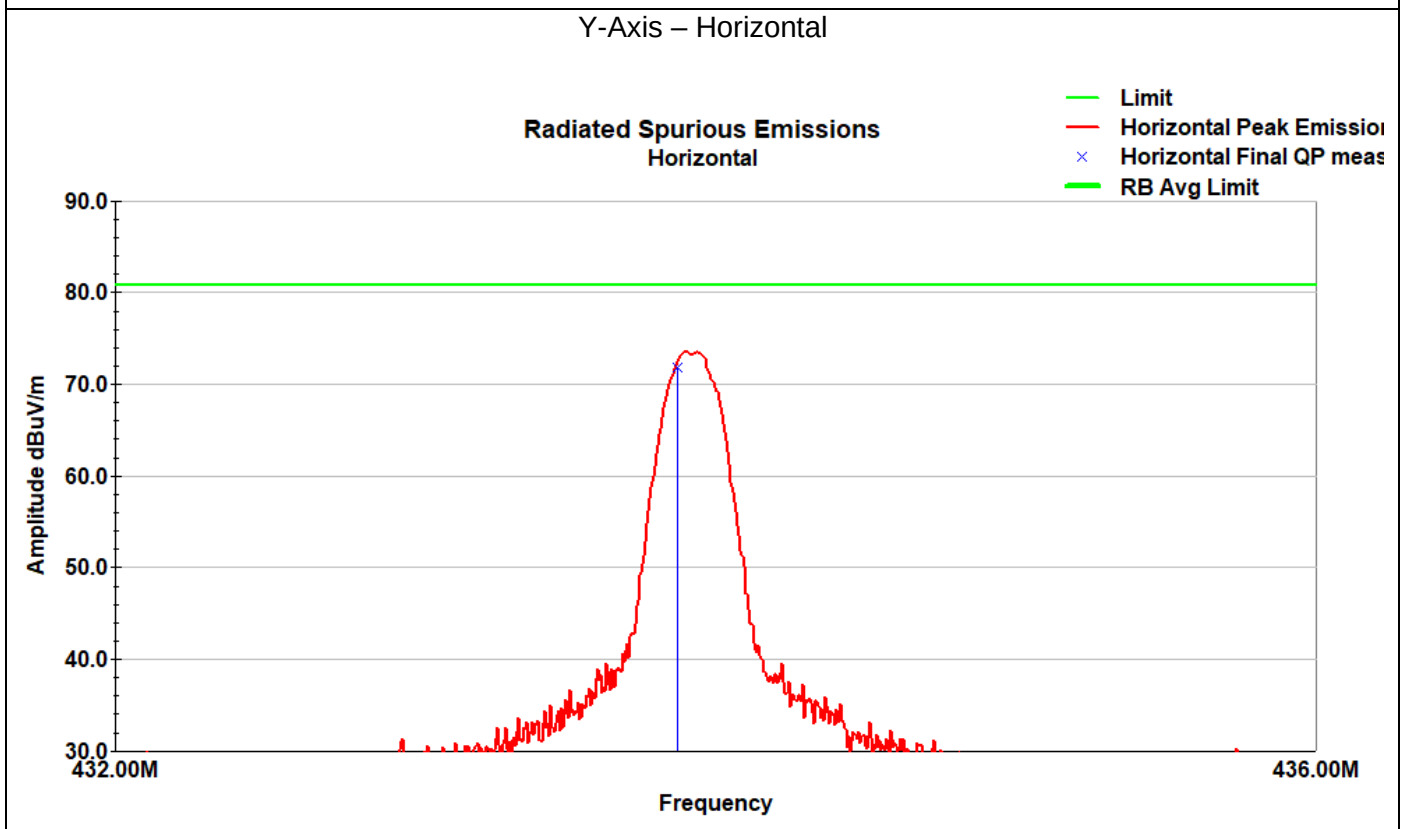
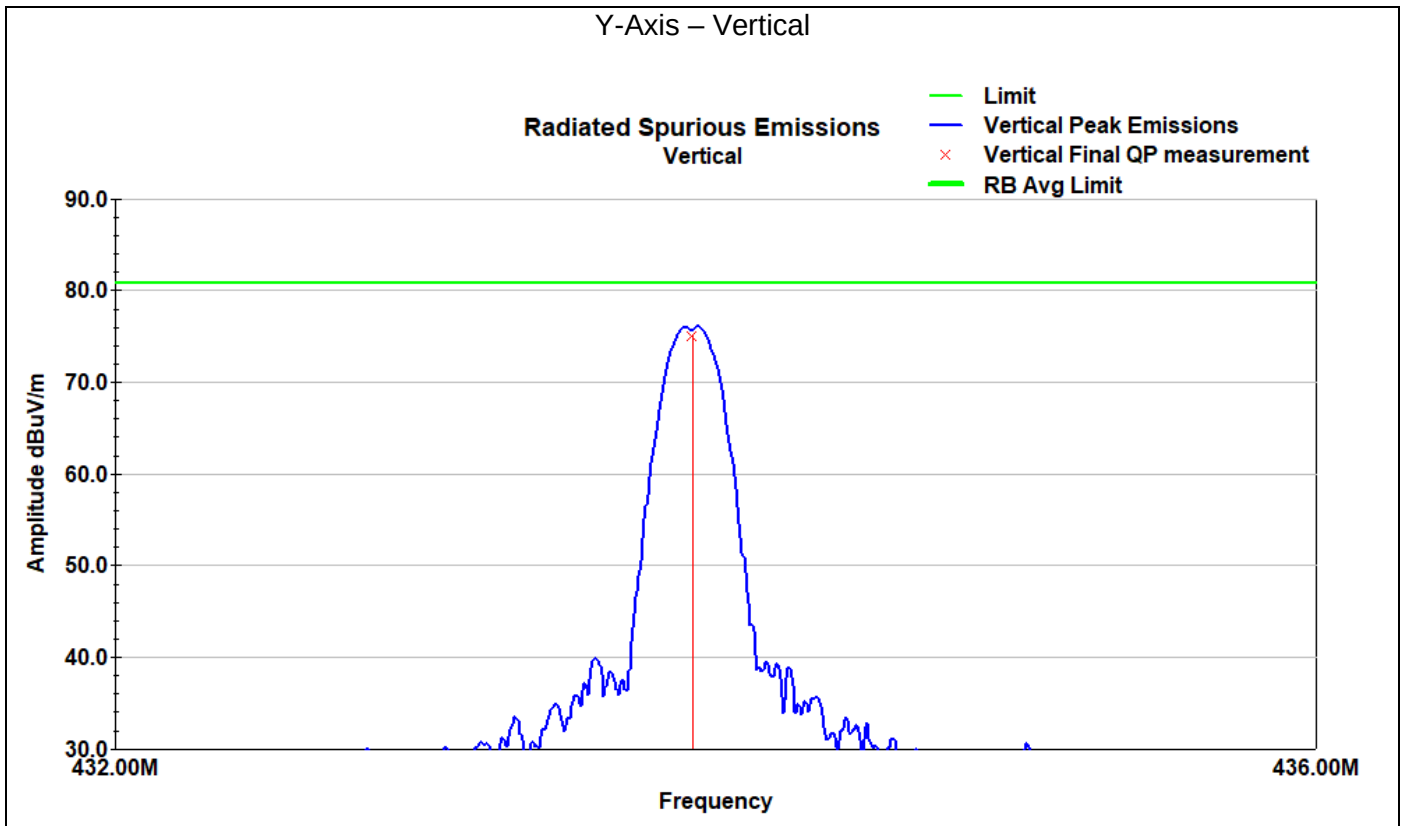
Duty Cycle				
Configuration	TX ON (ms)	Period, T (ms)	Duty Cycle (%)	DCCF (dB)
Normal	32	100	32	-9.9

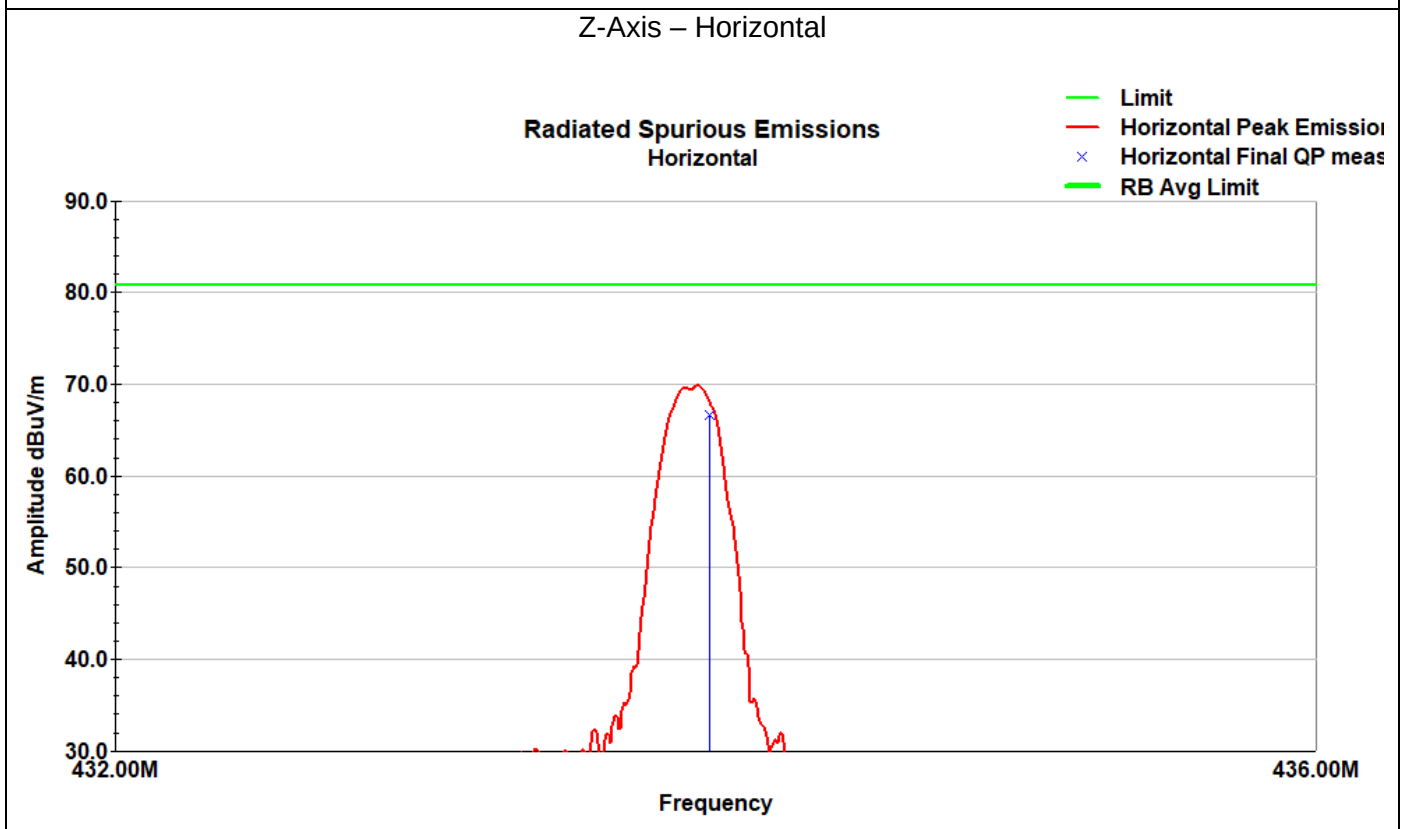
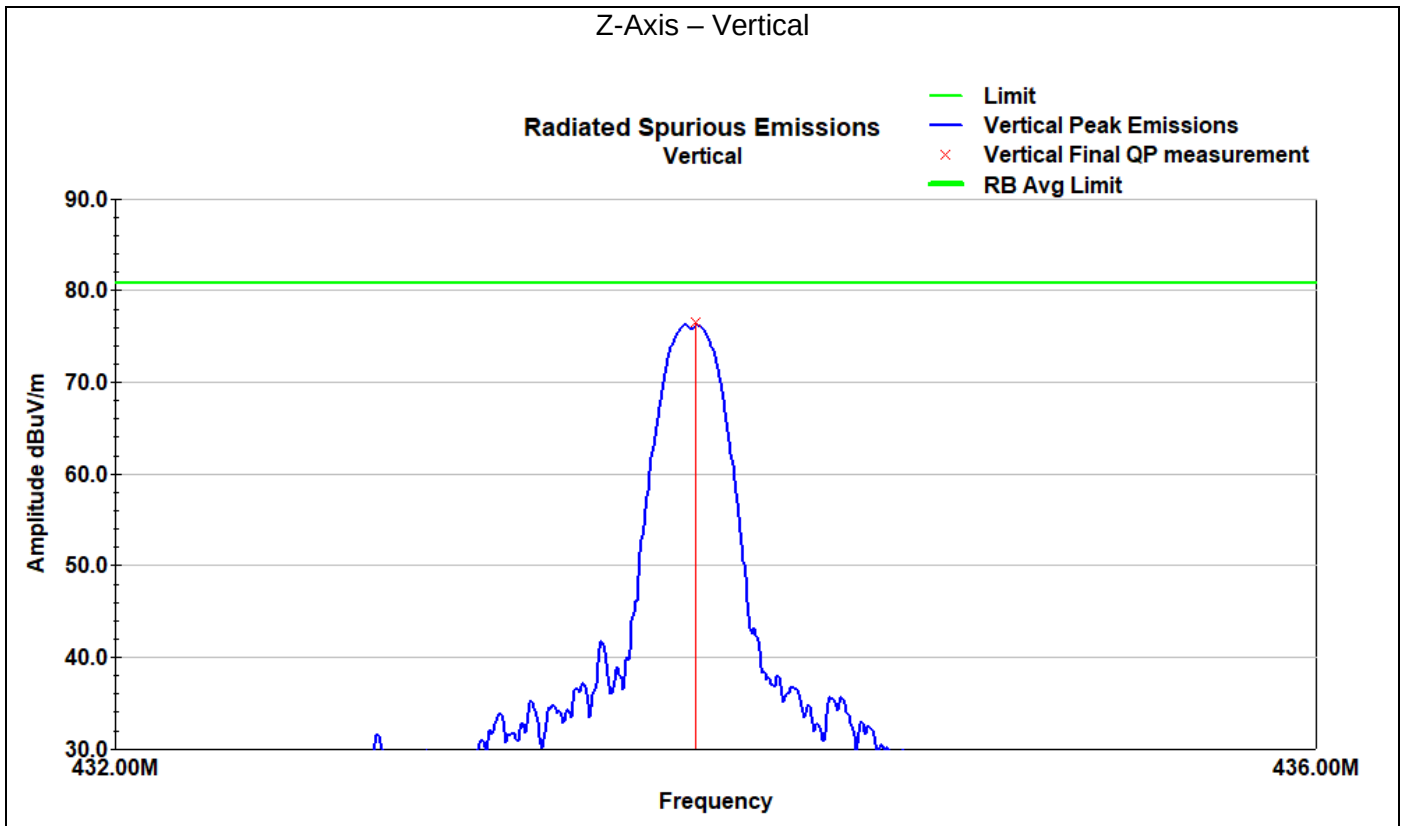


Date: 1.FEB.2023 12:16:49

4.7 Test Data – Plots







4.8 Test Data – Tabular

EUT Axis	Frequency	Raw Ave	Polarity	Azimuth	Height	DCCF	AF	Loss	Amp	Value	Ave Limit	Margin
	MHz	(dBuV)	(V/H)	(degrees)	(cm)	(dB)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
X	433.92	58.4	V	166.0	266.0	9.9	20.8	3.4	30.3	62.2	80.8	-18.6
X	433.95	69.0	H	252.0	245.0	9.9	20.8	3.4	30.3	72.8	80.8	-8.0
Y	433.92	70.8	V	360.0	100.0	9.9	20.8	3.4	30.3	74.6	80.8	-6.2
Y	433.87	64.9	H	93.0	100.0	9.9	20.8	3.4	30.3	68.7	80.8	-12.1
Z	433.93	71.9	V	181.0	117.0	9.9	20.8	3.4	30.3	75.7	80.8	-5.1
Z	433.98	59.5	H	274.0	399.0	9.9	20.8	3.4	30.3	63.3	80.8	-17.6

5 Field Strength of Spurious Radiation

5.1 Test Result

Test Description	Test Specification		Test Result
Field strength of spurious emissions	15.231(b)	RSS-210, A.1.2	Compliant
	ANSI C63.10:2013, Section 6.5		

5.2 Test Method

Exploratory scans were performed using the max hold function and incorporating a Peak detector and using TILE! software. The final test data was measured using a Quasi-Peak detector below 1GHz and a Peak detector above 1GHz. For harmonics of the fundamental, Average measurements were made by correcting the peak value with the duty cycle correction factor. For emissions other than harmonics of the fundamental, the Average measurements were made using the Average detector. The receiver's resolution bandwidth was set to 120 kHz for measurements taken in the 30MHz to 1GHz frequency range and 1MHz for measurements for 1GHz and higher. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency. The radiated measurements were recorded and compared to the limits indicated in the table below.

The EUT was oriented in each of its three orthogonal axes and data for each was reported.

Limits for average value of emissions measured at 3m distance

Fundamental frequency (MHz)	FCC	RSS-210
	Field strength of spurious emission (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	225	Not allowed
70-130	125	
130-174	125 to 375 ¹	
174-260	375	
260-470	375 to 1250 ¹	
Above 470	1250	

1) Linear interpolations

From the table above, the spurious emission limit for a 433.93 MHz fundamental frequency is determined by linear interpolation to be 60.83 dBuV/m.

Spurious emissions shall meet the average limits shown in the table above or to the general limits in §15.209, whichever limit permits a higher field strength.

5.3 Test Site

10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Test Date:	27-Jan-2023	01-Feb-2023
Temperature:	21.3°C	21.8 °C
Relative Humidity:	23.0 %	39.6 %
Atmospheric Pressure:	98.8 kPa	98.6 kPa

5.4 Test Equipment

Test End Date: 27-Jan-2023

Tester: DA

Equipment	Model	Manufacturer	Asset	Cal Date	Cal Due Date
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	7-Dec-2022	7-Dec-2023
RF CABLE (TS8997)	141	HUBER & SUHNER	B095585	5-Jul-2022	5-Jul-2023
NEAR FIELD PROBES	N/A	COM-POWER CORPORATION	16016	CNR	CNR

Test End Date: 1-Feb-2023

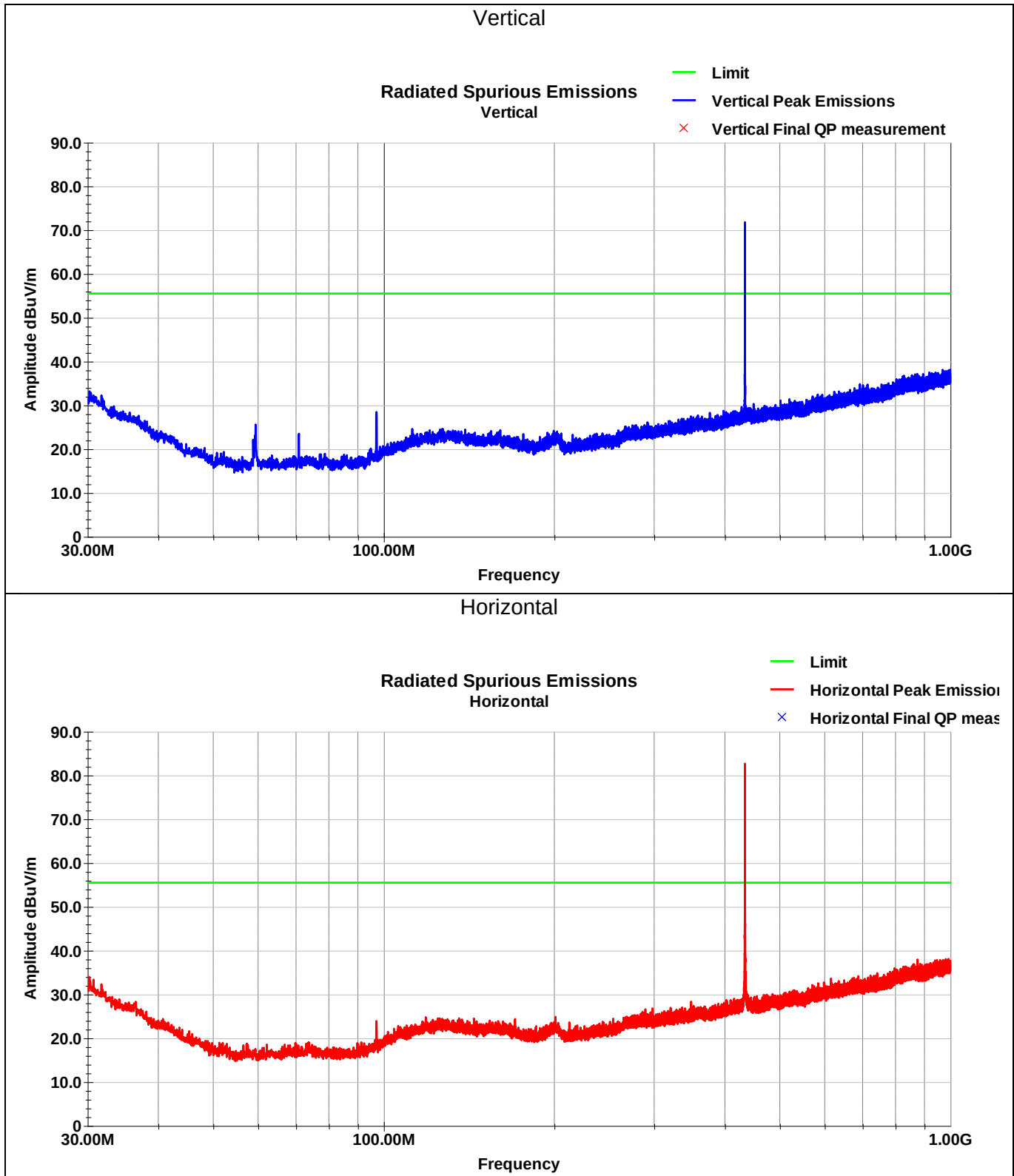
Tester: DA

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
EMI TEST RECEIVER	ESW44	ROHDE & SCHWARZ	22027	13-Sep-2022	13-Sep-2023
RF CABLE RIGHT ANGLE NM TO	90-076-020	TELEDYNE STORM MICROWAVE	20131	16-Mar-2022	16-Mar-2023
LOW NOISE AMPLIFIER	ZKL-2+	MINI-CIRCUITS	B079817	25-Aug-2022	25-Aug-2023
RF CABLE NM TO NM, 0.01-18GHZ	90-195-079	TELEDYNE STORM MICROWAVE	20124	14-Feb-2022	14-Feb-2023
RF CABLE	SF106	HUBER & SUHNER	B079713	25-Aug-2022	25-Aug-2023
N to N RF Cable	NC12-N1N1-276	MEGAPHASE	22000	9-Jan-2023	9-Jan-2024
ANTENNA, BILOG	JB6	SUNOL	B079690	19-Apr-2022	19-Apr-2024

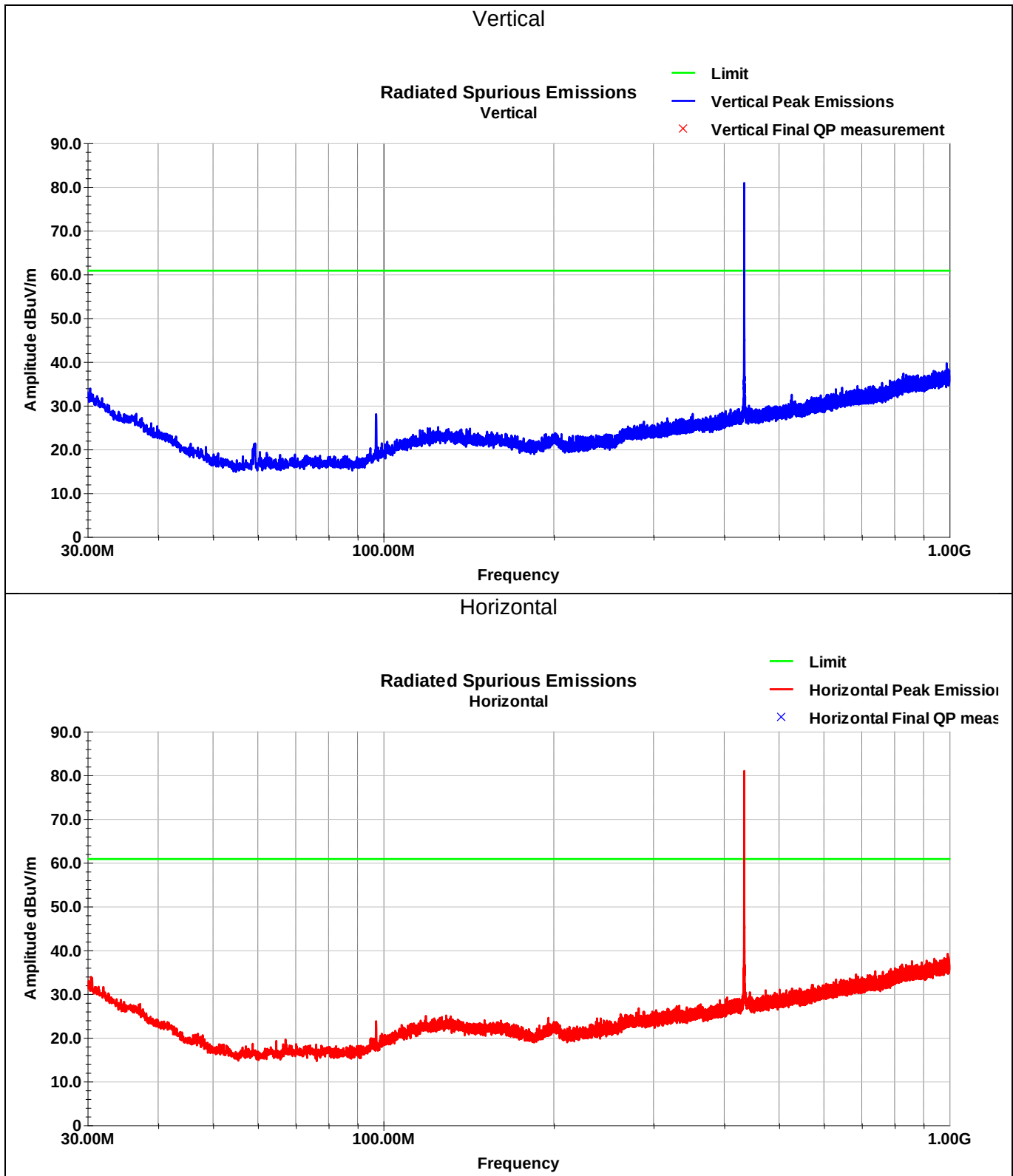
Software: "RSE 30-1000 MHz T7 220318" TILE7 profile dated 18 March 2022

5.5 Test Data – Below 1 GHz

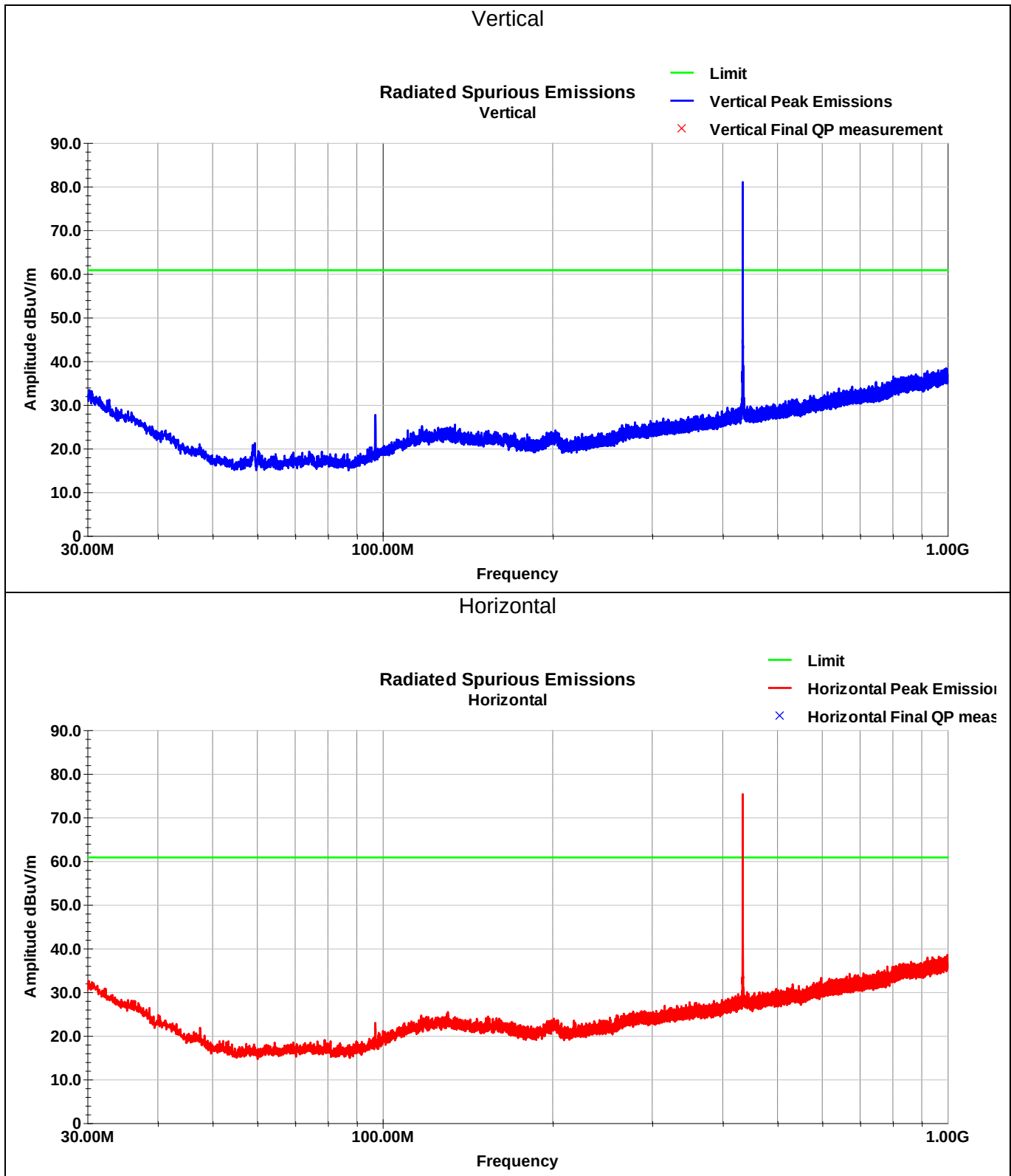
5.5.1 X-Axis



5.5.2 Y-Axis



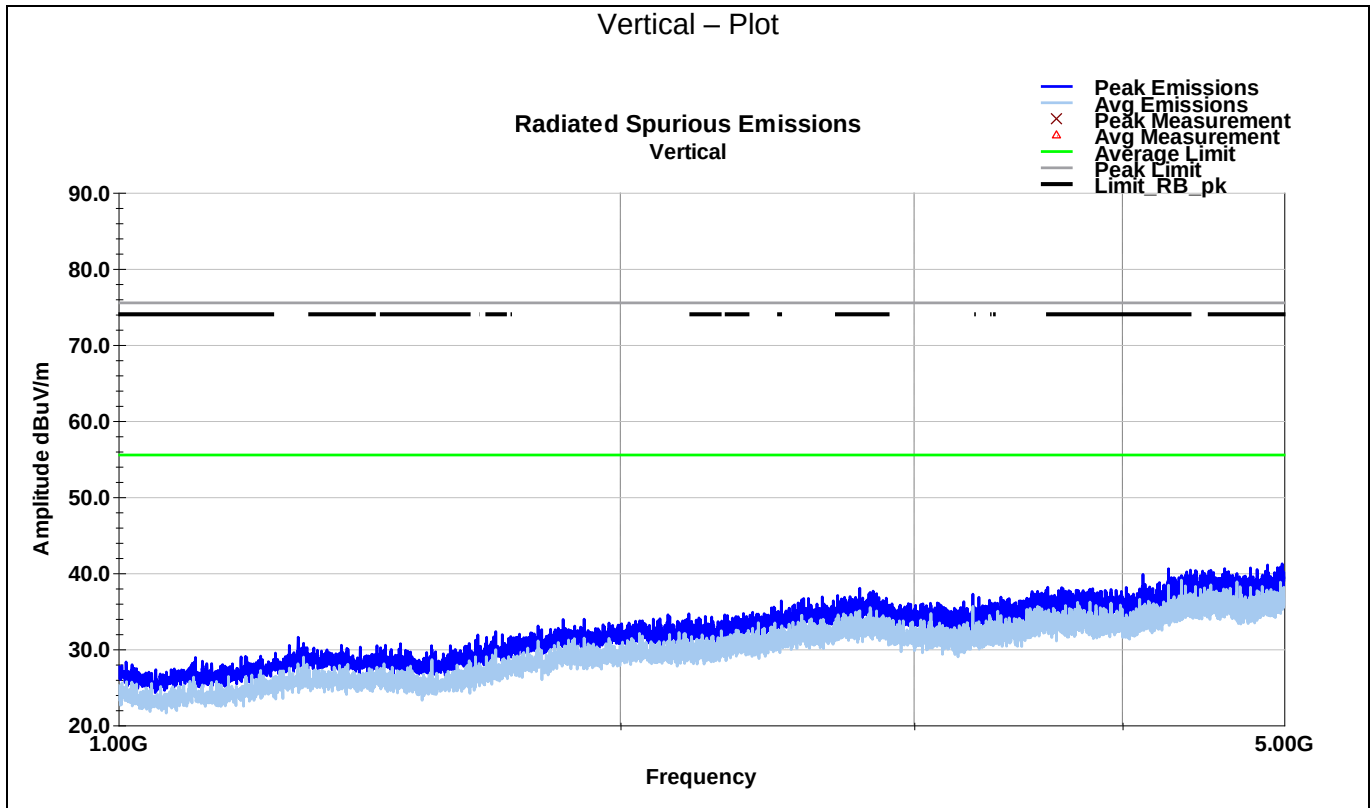
5.5.3 Z-Axis



Only intentional radiator exceeds spurious emission limit

5.6 Test Data – Above 1 GHz

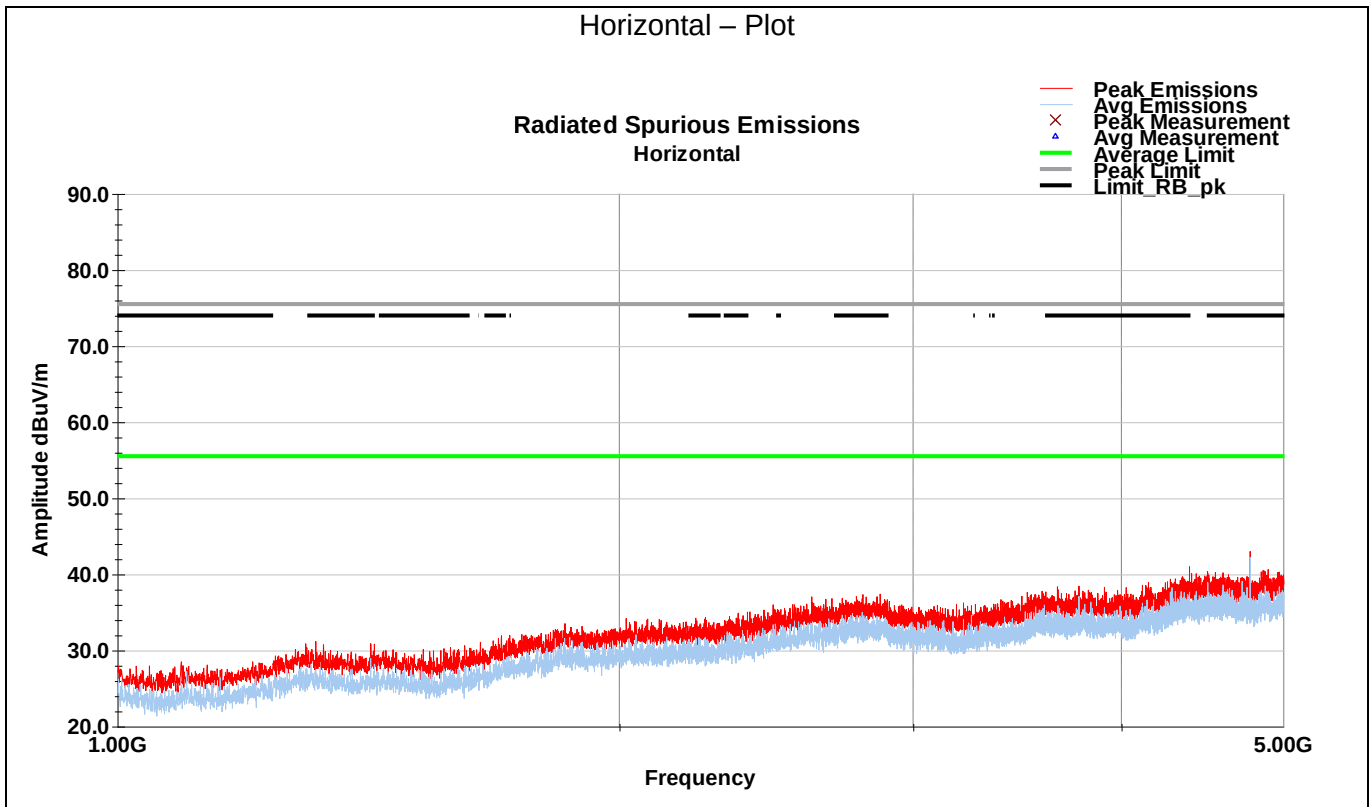
5.6.1 X-Axis



Vertical – Tabular Data

None

No discernable emissions detected above noise floor.

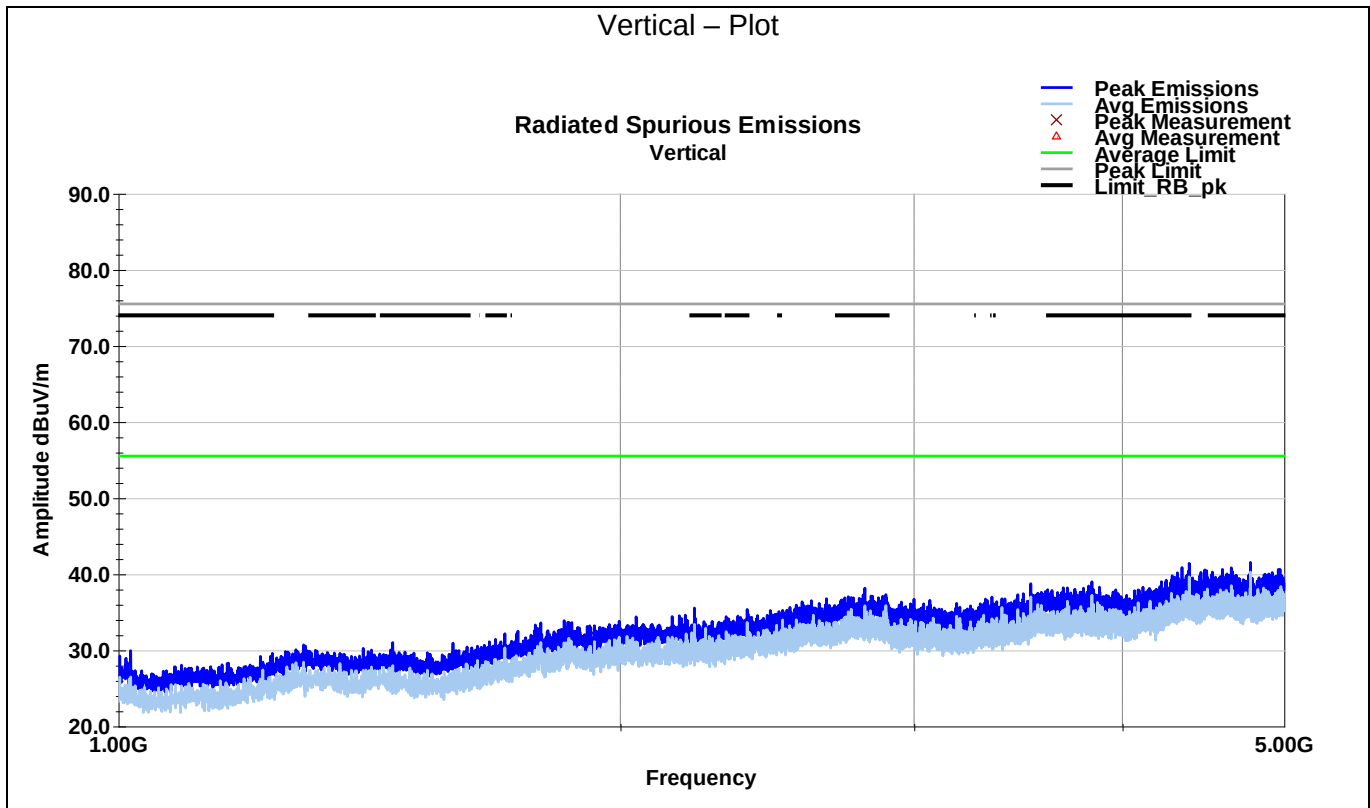


Horizontal – Tabular Data

None

No discernable emissions detected above noise floor.

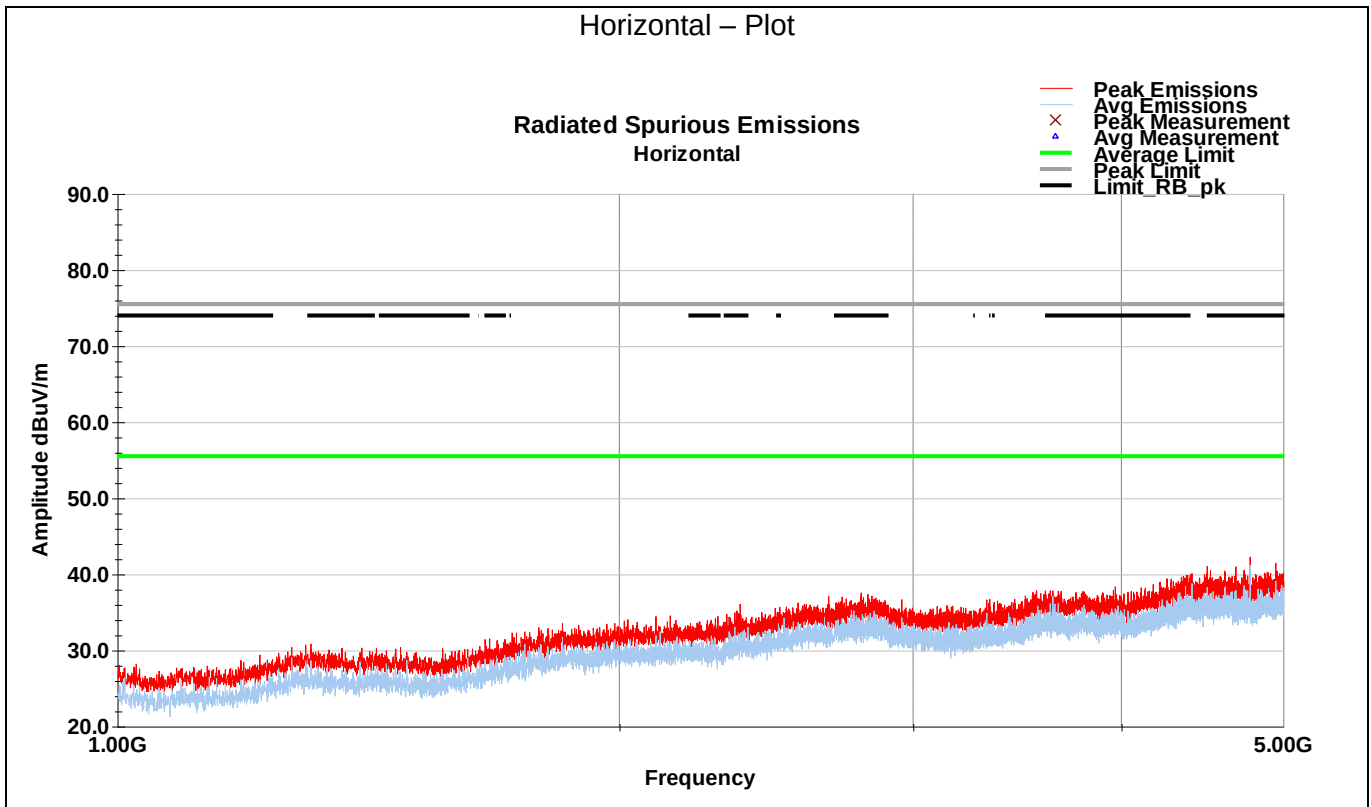
5.6.2 Y-Axis



Vertical – Tabular Data

None

No discernable emissions detected above noise floor.

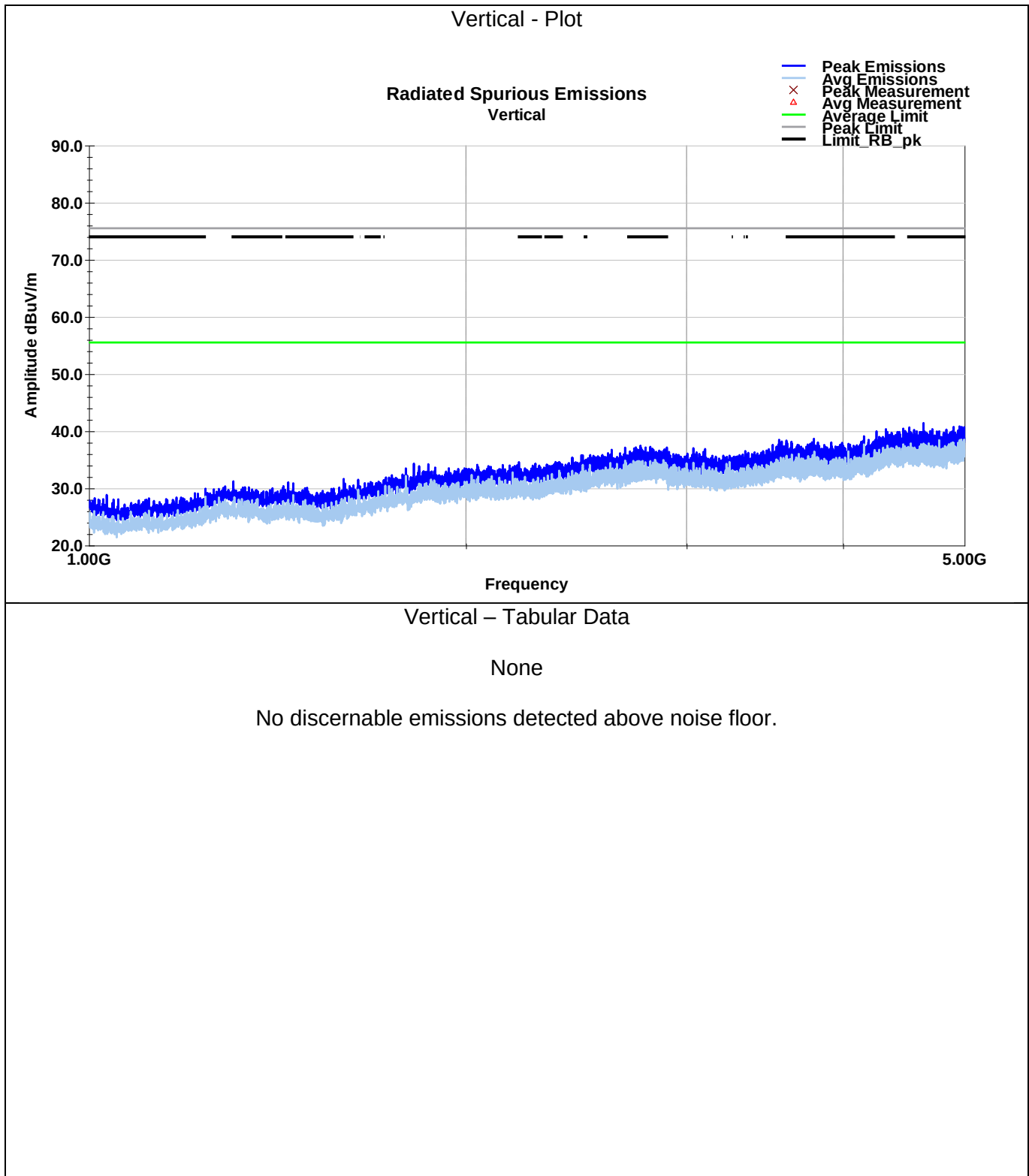


Horizontal – Tabular Data

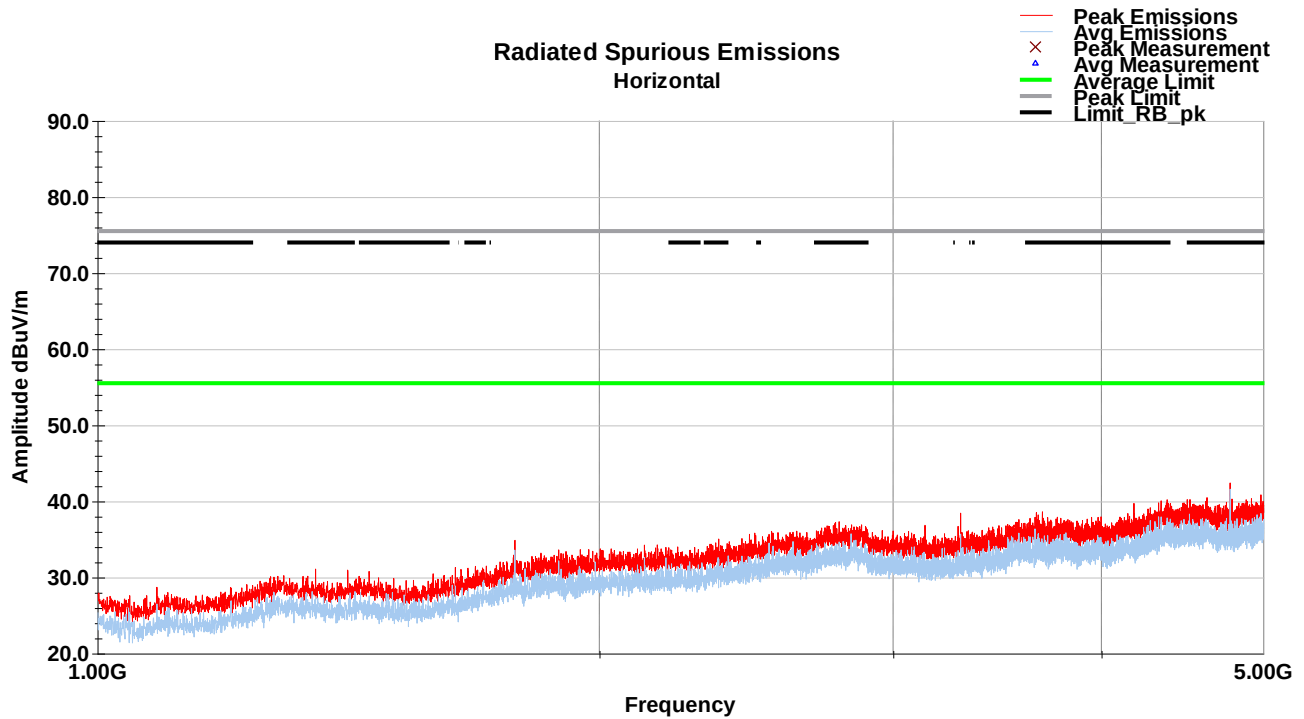
None

No discernable emissions detected above noise floor.

5.6.3 Z-Axis



Horizontal – Plot



Horizontal – Tabular Data

None

No discernable emissions detected above noise floor.

6 Bandwidth

6.1 Test Result

Test Description	Test Specification		Test Result
20 dB Bandwidth	15.231(c)	RSS-210 A.1.3	Compliant

6.2 Test Method

The procedures from ANSI C63.10 (2013) clause 6.9 were used to determine the 20 dB bandwidth.

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

6.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 21.8 °C

Relative Humidity: 26.7 %

Atmospheric Pressure: 98.7 kPa

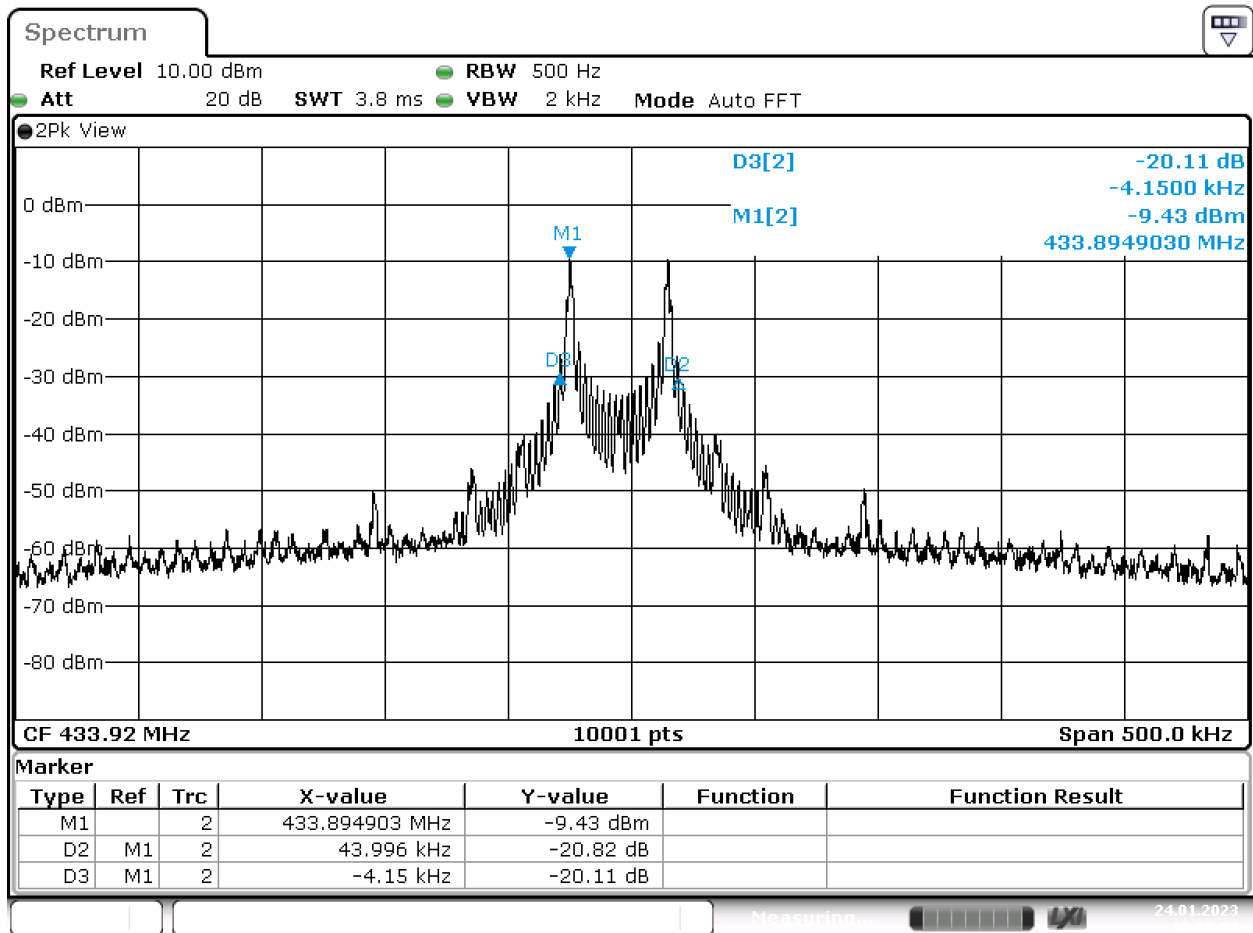
6.4 Test Equipment

Test End Date: 24-Jan-2023

Tester: DA

Equipment	Model	Manufacturer	Asset	Cal Date	Cal Due Date
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	7-Dec-2022	7-Dec-2023
RF CABLE (TS8997)	141	HUBER & SUHNER	B095585	5-Jul-2022	5-Jul-2023
NEAR FIELD PROBES	N/A	COM-POWER CORPORATION	16016	CNR	CNR

6.5 Test Data



Date: 24.JAN.2023 14:53:51

The maximum allowable bandwidth is 0.25% of 433.92 MHz which is 1.084MHz.

The measured bandwidth derived from the plot above is 48.146kHz.

The EUT complies with the limit.

7 Deactivation Time

7.1 Test Result

Test Description	Test Specification		Test Result
Deactivation time, manual	15.231(a)(1)	RSS-210 A.1.1a	Compliant
	ANSI C63.10:2013, Section 7.4		

7.2 Test Method

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

7.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 21.8 °C

Relative Humidity: 26.7 %

Atmospheric Pressure: 98.7 kPa

7.4 Test Equipment

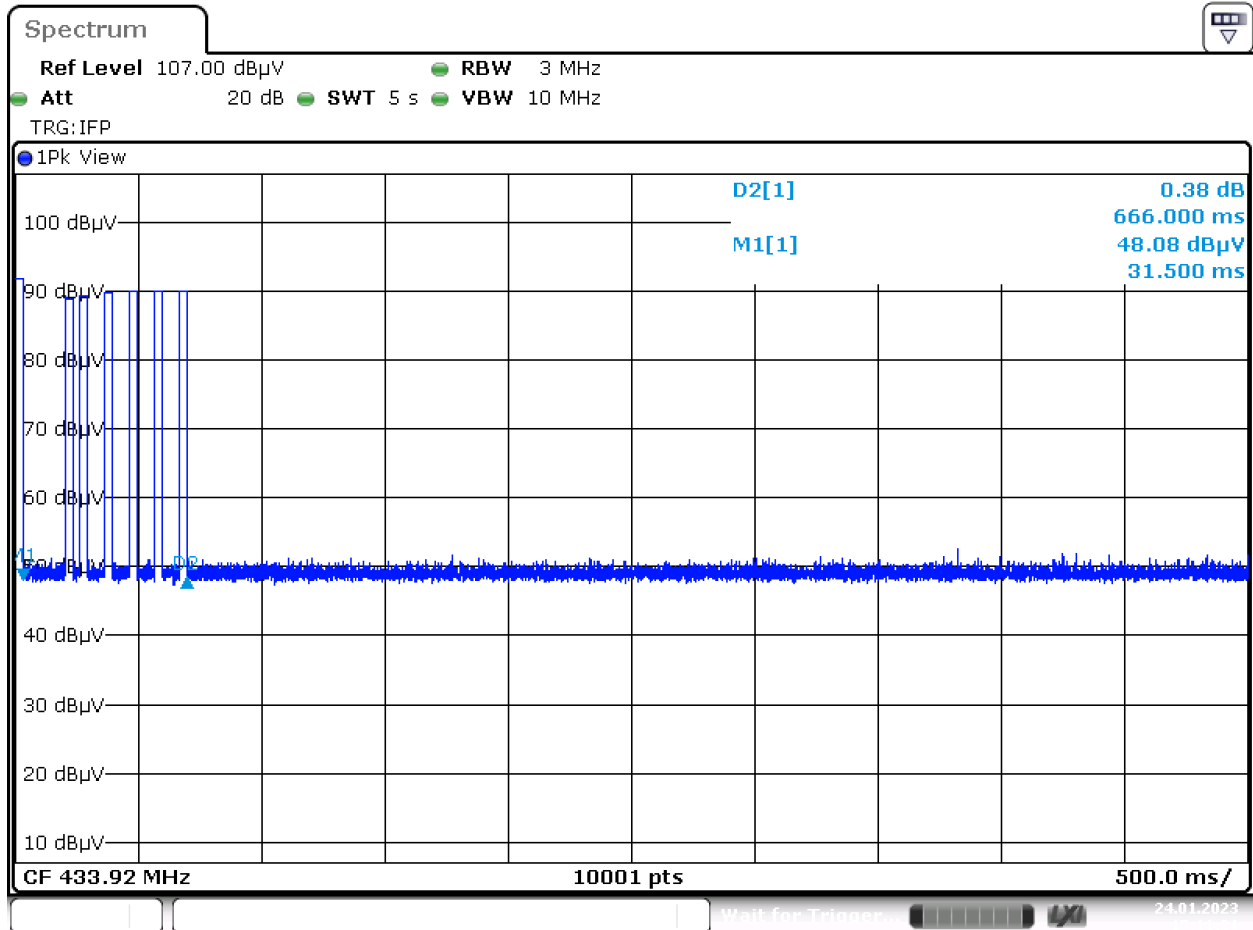
Test End Date: 24-Jan-2023

Tester: DA

Equipment	Model	Manufacturer	Asset	Cal Date	Cal Due Date
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	7-Dec-2022	7-Dec-2023
RF CABLE (TS8997)	141	HUBER & SUHNER	B095585	5-Jul-2022	5-Jul-2023
NEAR FIELD PROBES	N/A	COM-POWER CORPORATION	16016	CNR	CNR

CNR = Calibration not required

7.5 Test Data



Date: 24.JAN.2023 15:11:22

The transmitter is deactivated within 0.4 seconds of the button being released.

8 Revision History

Revision Level	Description of changes	Revision Date
Draft	--	02 February 2023
0	Initial release	02 February 2023
1	Re-testing of Field Strength of Fundamental with lower output.	02 March 2023